rior be encouraged. No new methods are suggested for securing these desirable ends, but an excellent statement is made of reasons why they should be sought.

Chapter VI. was originally written as a protest against eugenics of the more rabid sort, and even in its present somewhat modified form presents a rather strong contrast to the preceding chapter. It takes issue with the fatalistic, mechanistic, view of development, which would assign to heredity all the ills that flesh is heir to, and would deprive the individual of all ability to alter his career and character or to deviate from the course which fate had marked out for him in the constitution of his germ-plasm. This protest had at the time and still has occasion and utility. The book as a whole is an attempt to evaluate biologically heredity and environment, to show that both are indispensable, and accordingly that neither should be emphasized to the neglect of the other. In this *balanced view* of the two sets of agencies lies the peculiar merit of this excellent book.

W. E. CASTLE

SPECIAL ARTICLES

MAGNETIZATION BY ROTATION

ABOUT six years ago I published in this journal a note in which it was shown that on the modern theory of magnetism any magnetic substance should become magnetized by a sort of molecular gyroscopic process on being set into rotation. Rotation should produce in any substance an intrinsic magnetic intensity parallel to the axis of rotation, proportional to the angular velocity, and (like the magnetization of the earth) directed oppositely to the magnetic intensity which would be produced by an electric current circulating around the substance in the direction of rotation. If the rotating body is magnetic, magnetization, proportional to the intensity, should result; otherwise not (except to a very minute extent).

Preliminary experiments mentioned in the note referred to appeared, though doubtfully, to show the effect in question in the case of a large iron rod rotated at a speed of about 90 revolutions per second. Later observations made in much the same way, but with an attempt at improvement in apparatus, failed to confirm this result with any certainty; and further investigation was postponed until better facilities were available.

Recently I have made, again with Mrs. Barnett's assistance, experiments which have yielded definite and conclusive results. In the final experiments two nearly similar rods of steel shafting were mounted with their axes horizontal and perpendicular to the magnetic meridian, and two similar coils of insulated wire were mounted about their centers. These coils were connected in series with one another and with a Grassot fluxmeter, and were oppositely wound so that any variations in the intensity of the earth's field produced no effect on the fluxmeter. One of the rods remained at rest; while the other, mounted in a region in which the earth's magnetic intensity was compensated by an electric current flowing in a very large coil, was alternately rotated by an air motor and brought to rest, the change of flux for different speeds and different directions of rotation being determined by the fluxmeter. The fluxmeter was compensated for extraneous electromotive forces, and was read by mirror and scale to 0.1 mm. at the scale distance 8 meters. After all suspected sources of systematic error were eliminated, an effect was left corresponding precisely with that predicted by the above theory and inexplicable on any other theory hitherto proposed. The intrinsic magnetic intensity of rotation per unit speed, and the change of flux-density at the center of the iron rod per unit speed, were found to be 3.1×10^{-7} gauss/r.p.s. and 1.9×10^{-5} maxwells/cm.^{2} per r.p.s., respectively.

From experiments made for a different purpose by Lebedew in 1912 it can be shown that in non-magnetic substances not more than a minute fraction of the magnetization we have observed in iron is produced at the same speed.

It is not, of course, possible to obtain iron rods entirely free from magnetization, and observations were always made on changes of residual flux. Together with the change of flux proportional to the angular velocity, the

effect being looked for, another change, proportional to the square of the angular velocity, was found and traced to the radial expansion of the rod produced by rotation.

The intensity of magnetization per unit speed produced at the center of the iron rod was about 1.5×10^{-6} c.g.s. unit per r.p.s. If the rod had been rotated at the speed of the earth, viz., 1/86400 r.p.s., its intensity of magnetization would have been about 2×10^{-10} that of the earth, and still less if the shape had been spherical. This, however, does not prove that even a very large part of the earth's magnetization may not be due to the effect in question, as we are entirely ignorant of the magnetic properties of all substances under the conditions prevailing within almost the whole of the earth. Schuster has pointed out that an effect of this kind may explain both the mean magnetization of the earth and the secular variation as well. It seems more likely, however, that a large part of terrestrial and solar magnetization is due to other causes, such as the outward radial displacement of electrons by centrifugal and thermionic action.

A full account of the work summarized here, and presented to the American Physical Society at its meetings of last December and April, will be published in the *Physical Review*.

S. J. Barnett

The Ohio State University

The Pond-Lily Aphid as a Plum Pest[1]

One of our best-known aphids common upon various water plants is *Rhopalosiphum nymphææ* (Linn.). This has received considerable attention as a "semi-aquatic" species which on account of the waxgland areas of its body appears to be particularly adapted to a life in moist localities and to suffer no inconvenience from contact with water while feeding on aquatic plants.

An account of this species under the title "A Lacustrine Aphid," by Professor T. D. A. Cockerell, appeared in Science (Vol. 22, p. 764) in 1905, and it is not necessary here to discuss the aquatic phases of its career, but merely to call attention to another chapter in the life cycle of *Rhopalosiphum nymphææ*—which proved a surprise to the writer and has evidently remained unsuspected by other observers of this species from Linné down to the present time.

One of the most troublesome of our plum aphids in Maine is a species inhabiting the shoots and the ventral surface of the leaves, ordinarily without causing curl or similar deformation of the leaf, but exhibiting a dangerous tendency to feed also upon the young fruit itself as well as tapping the fruit stems.

After watching this plum aphid several years, and wondering where its summer home might be (for it is a migratory species, leaving the plum in June), it finally dawned upon the writer that there were apparently no structural characters to separate this from the common pond lily aphid, *R. nymphææ*. Peculiar waxgland areas and all, the plum pest appeared to be identical with the species long known to science upon various water plants.

This spring the writer made the "migration test" by placing the spring migrants (alate viviparous forms) from plum upon water plantain, *Alisma Plantago-aquatica;* arrowhead, *Sagittaria latifolia;* and cat-tail flag, *Typha latifolia;* which had been potted and kept under laboratory control. These three plants are on the approved dietary of *R. nymphææ* and the plum migrants accepted them all readily, and the progeny of the plum migrants are perfectly content with the habitat given them.

Thus the life cycle of the ancient aphid is found to include a residence upon the plum, migrating thence to water plants for the summer and returning to the plum in the fall for the deposition of the over-wintering egg which provides for its spring generations upon that tree.

It is not the purpose of this note to discuss the synonymy of the aphid here considered, but it might be stated that it apparently exists under a name more recent than *nymphææ* in its rôle as a European plum pest.

Edith M. Patch

[1] Papers from the Maine Agricultural Experiment Station: Entomology No. 75.